LVIS –OIB 2012 Antarctica Grid Mapping and Flights

The following document presents LVIS flight lines and sample plans to be considered for the Fall 2012 Antarctica G-V OIB deployment.

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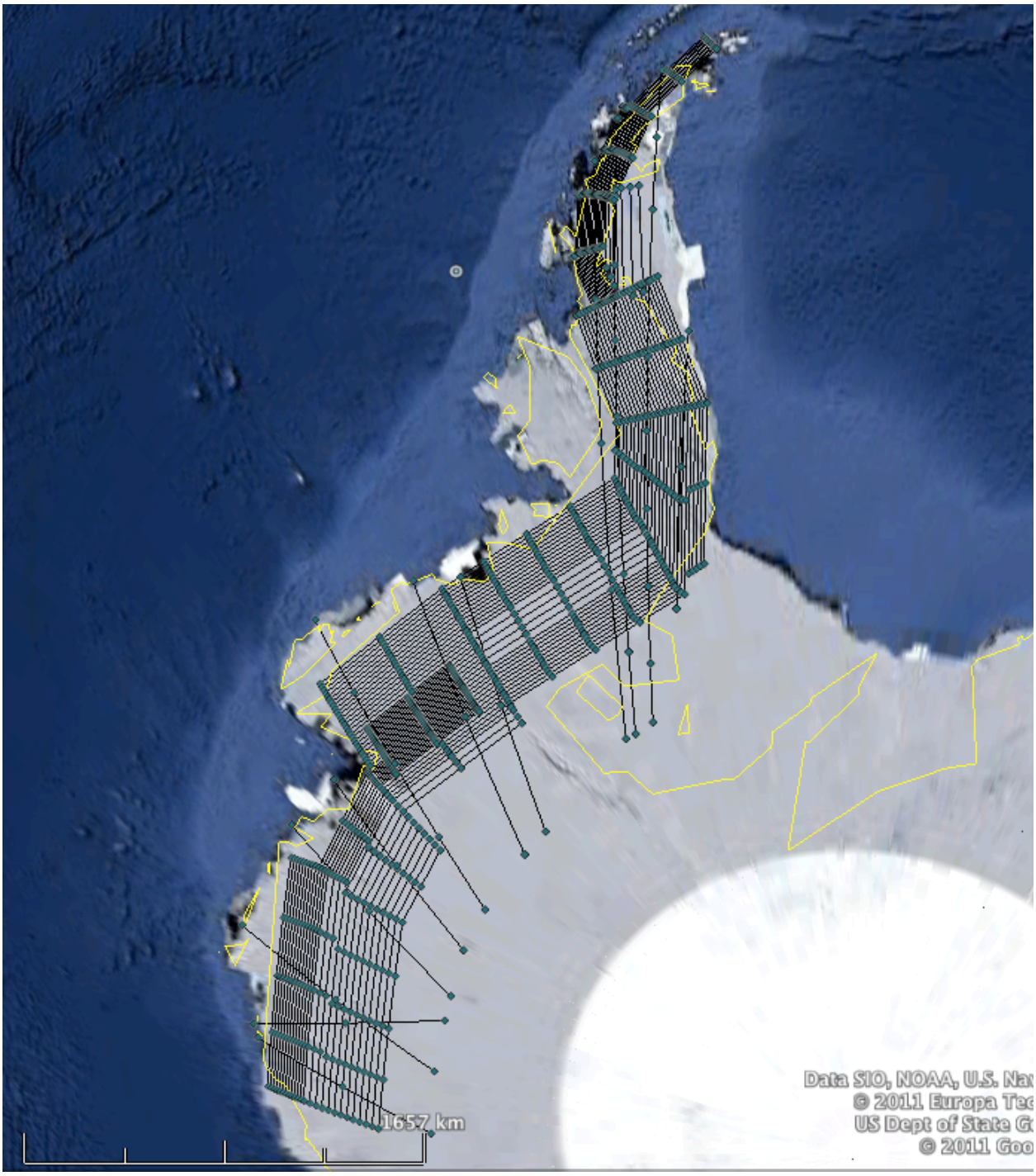


Introduction

These flight lines continue the grid sampling approach using the LVIS high altitude laser altimeter system begun in Antarctica in 2011 as well as specific target lines requested at the Seattle Meeting including high-priority ICESat tracks and OIB repeat observations. The grid sampling approach is intended to address the OIB science requirements, while maximizing spatial coverage in constructing a datum to link ICESat-1, ICESat-2 and GRACE. The priority areas for the grid sampling approach have been chosen based on coverage obtained in 2011, persistent weather problem areas, and the latest results from GRACE "global-ice" mascons. As with previous LVIS high-altitude deployments, it is expected that the final flight planning of grid lines will be made in the field and be based on science team priorities and weather.

Direct connection to OIB Baseline Science Requirements:

IS1: Measure surface elevation with a vertical accuracy of 0.5m or better.

IS2: Measure annual changes in ice sheet surface elevation sufficiently accurate to detect 0.15m changes in uncrevassed and 1.0m changes in crevassed regions along sampled profiles over distances of 500m. We are repeating existing altimetry lines flown by LVIS in 2009 and 2011, as well as crossing lines laid down by ATM and LVIS 2009-2011.

IS7: Collect elevation data so that the combined ICESAT-1-OIB sampling provides an elevation measurement within 10km for 90% of the area within 100km of the edge of the ice sheet. Each area has a densification of flight lines within 100-km of the edge of the continuous ice sheet.

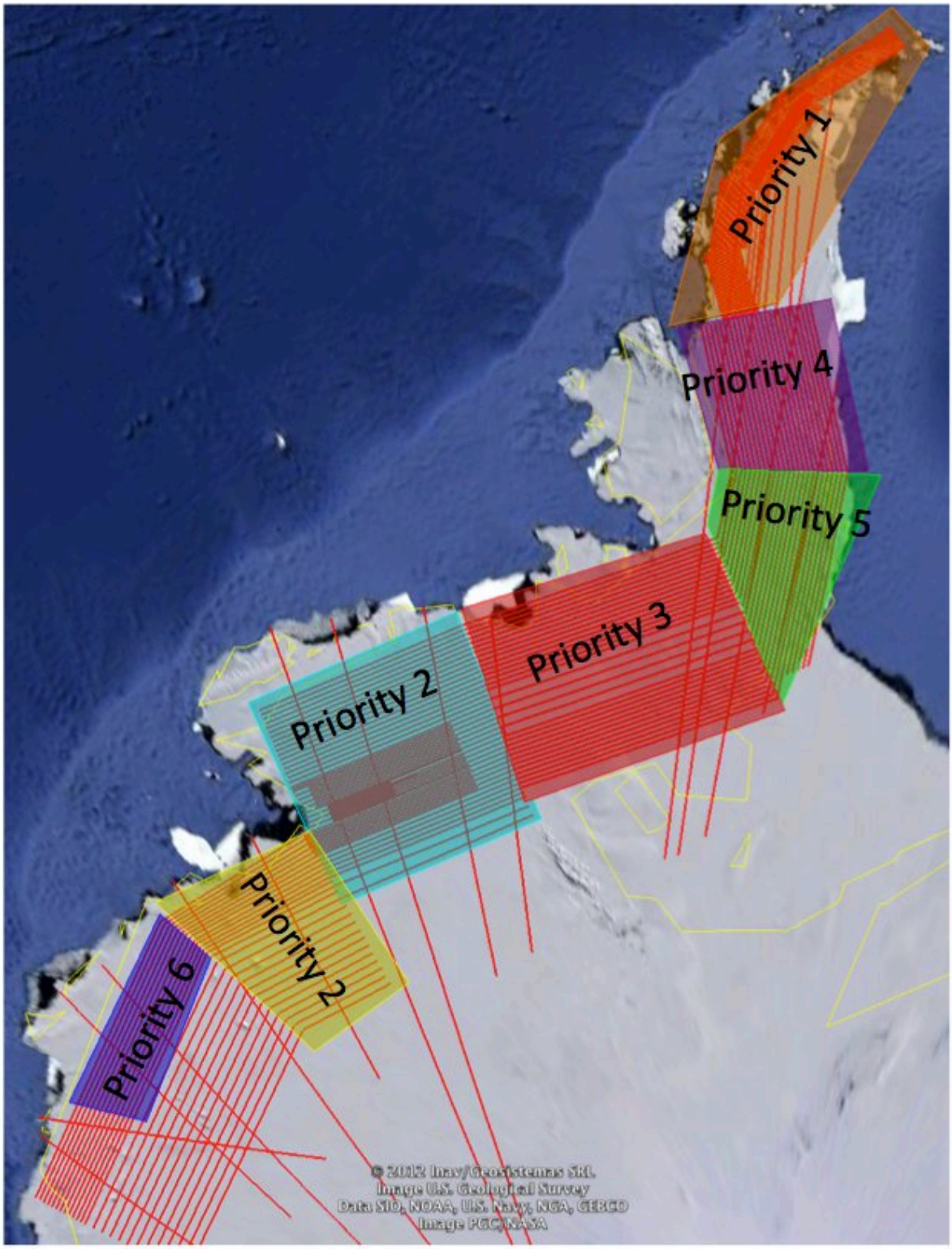
IS6: Remeasure surface elevation along established airborne altimeter and ICESat lines that extend from near the glacier margin to near the ice divide. Several candidate ICESat- 1 tracks selected based on their temporal and along-track sampling between the glacier margin and divide. In addition, the LVIS swath mapping provides an abundance of ICESat-1 and future mission (ICESat-2) underflight data.

IS9: Measure once surface elevation across flow transects at 3km and 8km upstream of the terminus. Flight lines provide the opportunity to acquire the across flow transects.

IS11: Measure elevation over 15 Antarctic glaciers that are rapidly changing or likely to change in next 10 years. The Peninsula area has a densification of flight lines to provide the basis of 5-km grid sampling with 10km or 20km grids elsewhere on the WAIS.

Note: In the following images, the full suite of LVIS grid lines is shown in black with those flown in 2011 in yellow. Lines selected for the currently-depicted 2012 plans are shown in red. The background image for many of the plans is the 1-km InSAR-based ice velocity map by Rignot et al.

Overview of Priority Box Locations

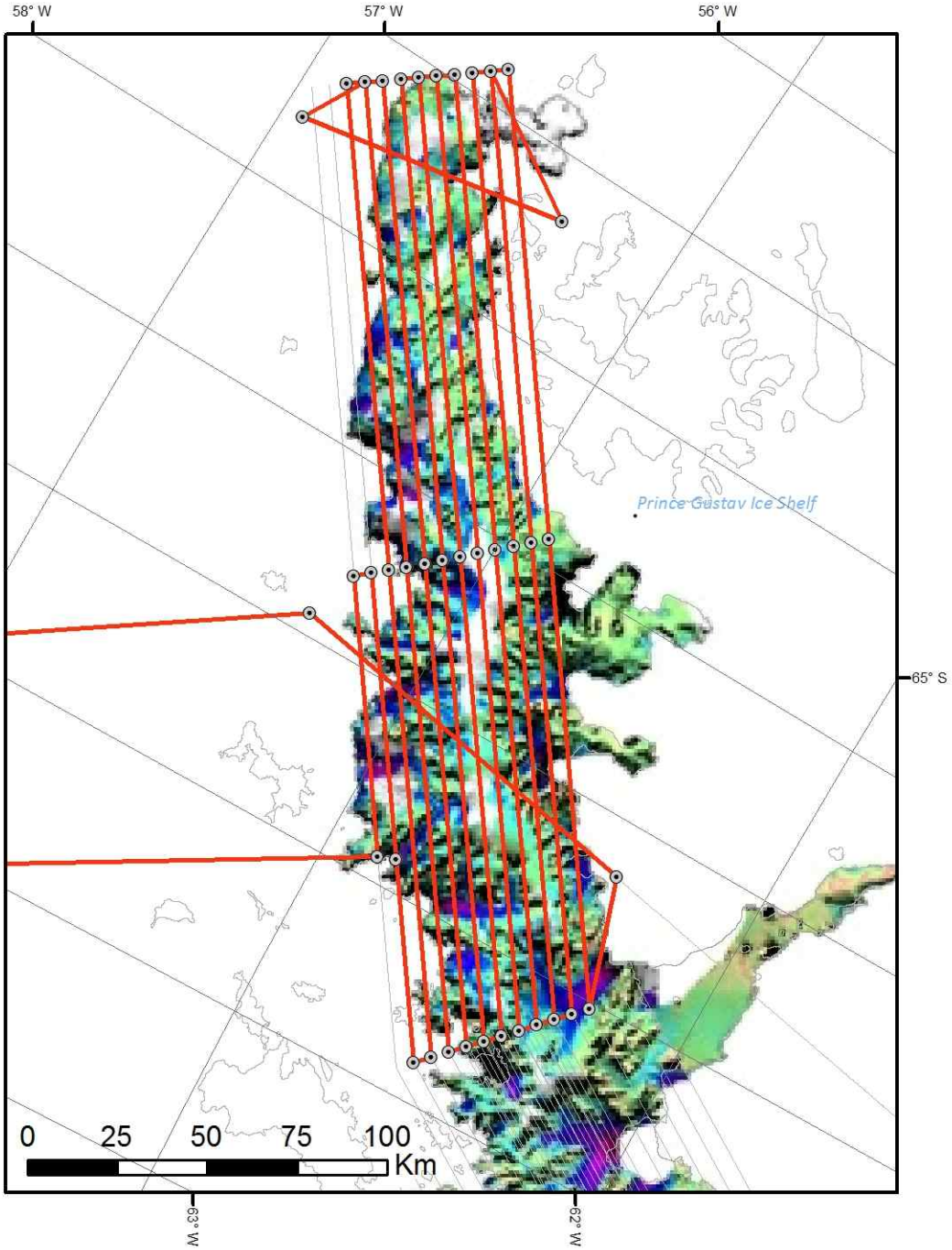


Overview of Possible Flight/Flight Areas

Peninsula:	**~5 flights**
Dyer:	**~2 flights**
Palmer:	**~ 2 flights**
Ellsworth/Evans:	**~3 flights**
Institute-Ice Plain:	**1 flight**
PIG:	**~5 flights**
Pope/Thwaites:	**~3 flights**
Getz:	**1 flight**
Sea ice:	**1 flight**

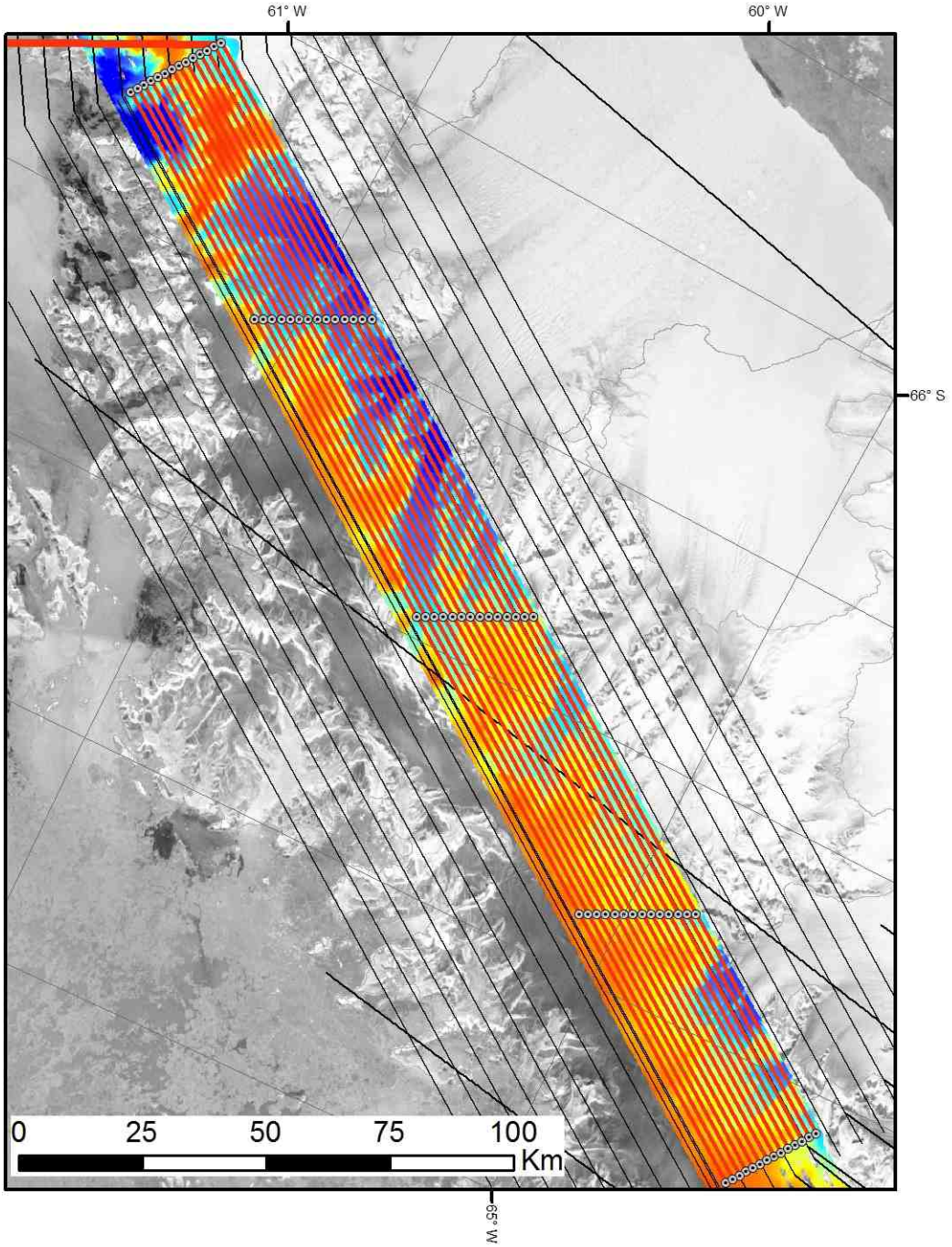
Peninsula: Priority 1
Flight: Pen Tip

5km spaced lines
Repeat of Icesat-1 track: 0367 and 1342



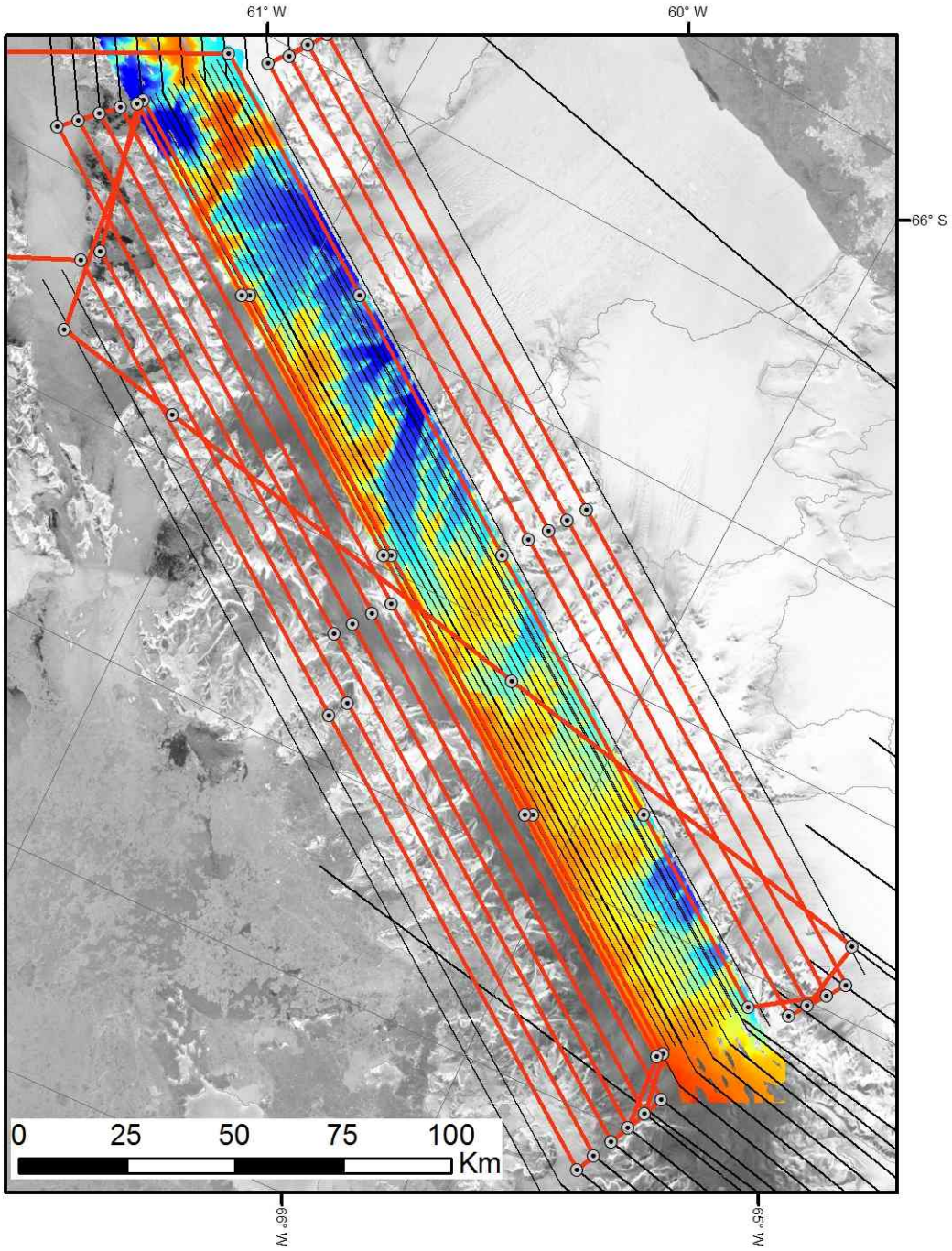
Peninsula: Priority 1
Flight: Crane Repeat ***Within P1 Area: Highest***

100% mapping of 250x 30km area.
Repeats 2009 LVIS flight. Captures numerous 2009-2011 low-altitude flight tracks.
Captures numerous Icesat-1 lines



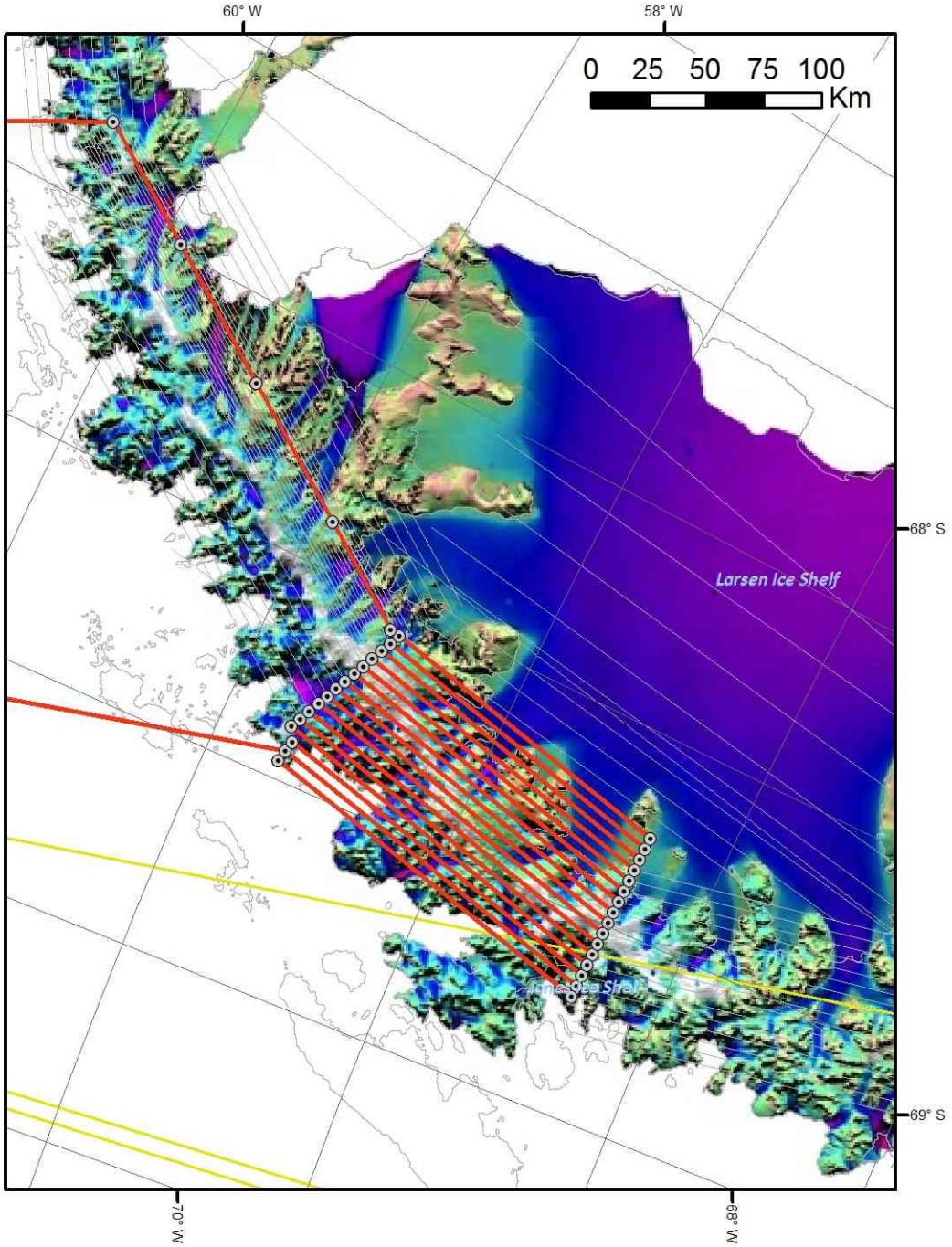
Peninsula: Priority 1
Flight: Crane Sandwich

5km line spacing to E and W of Crane mapping flight
Repeat of Icesat-1 track: 0010



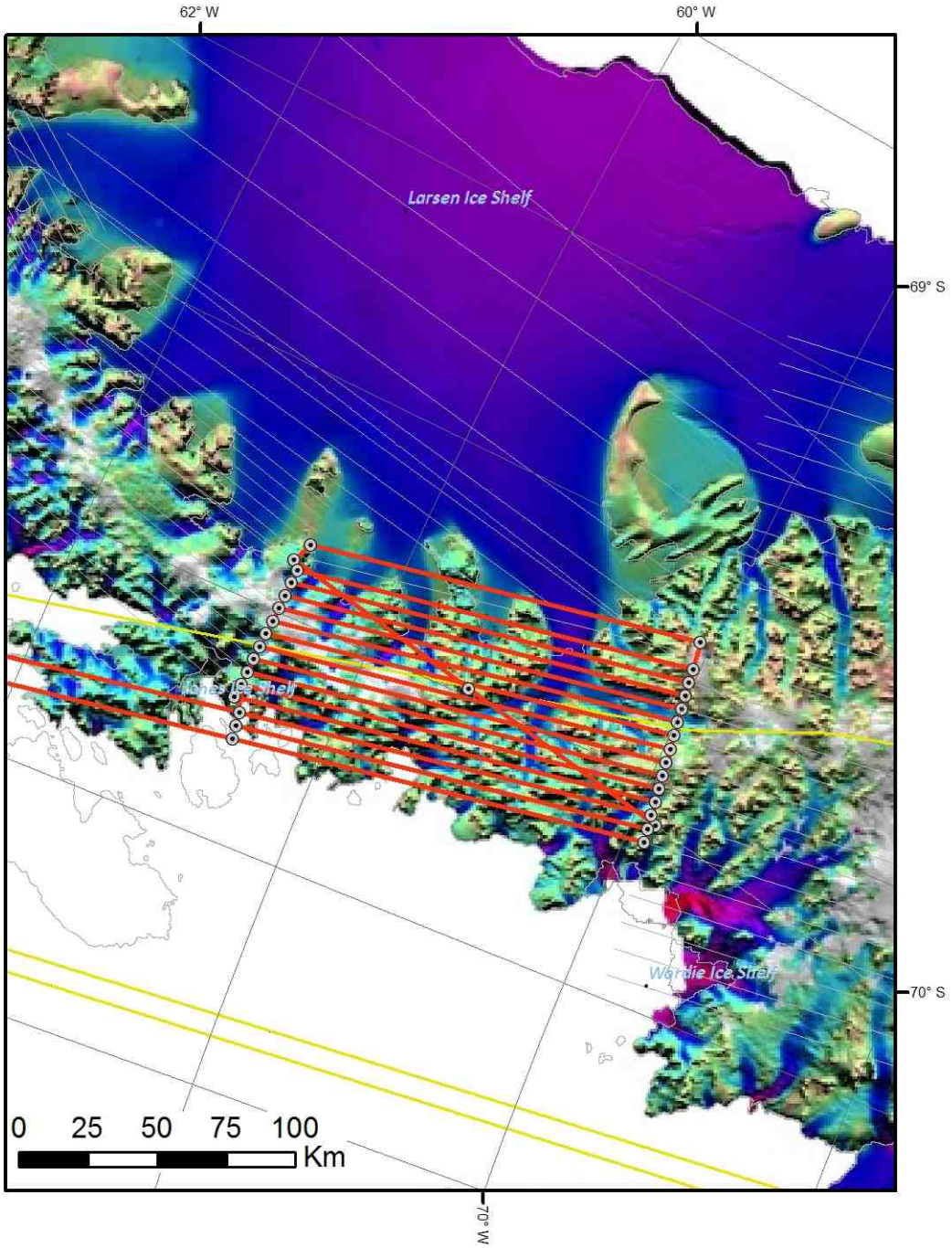
Peninsula: Priority 1
Flight: North Larsen

5km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Shown including possible transit over Upper Peninsula (little impact on flight time).

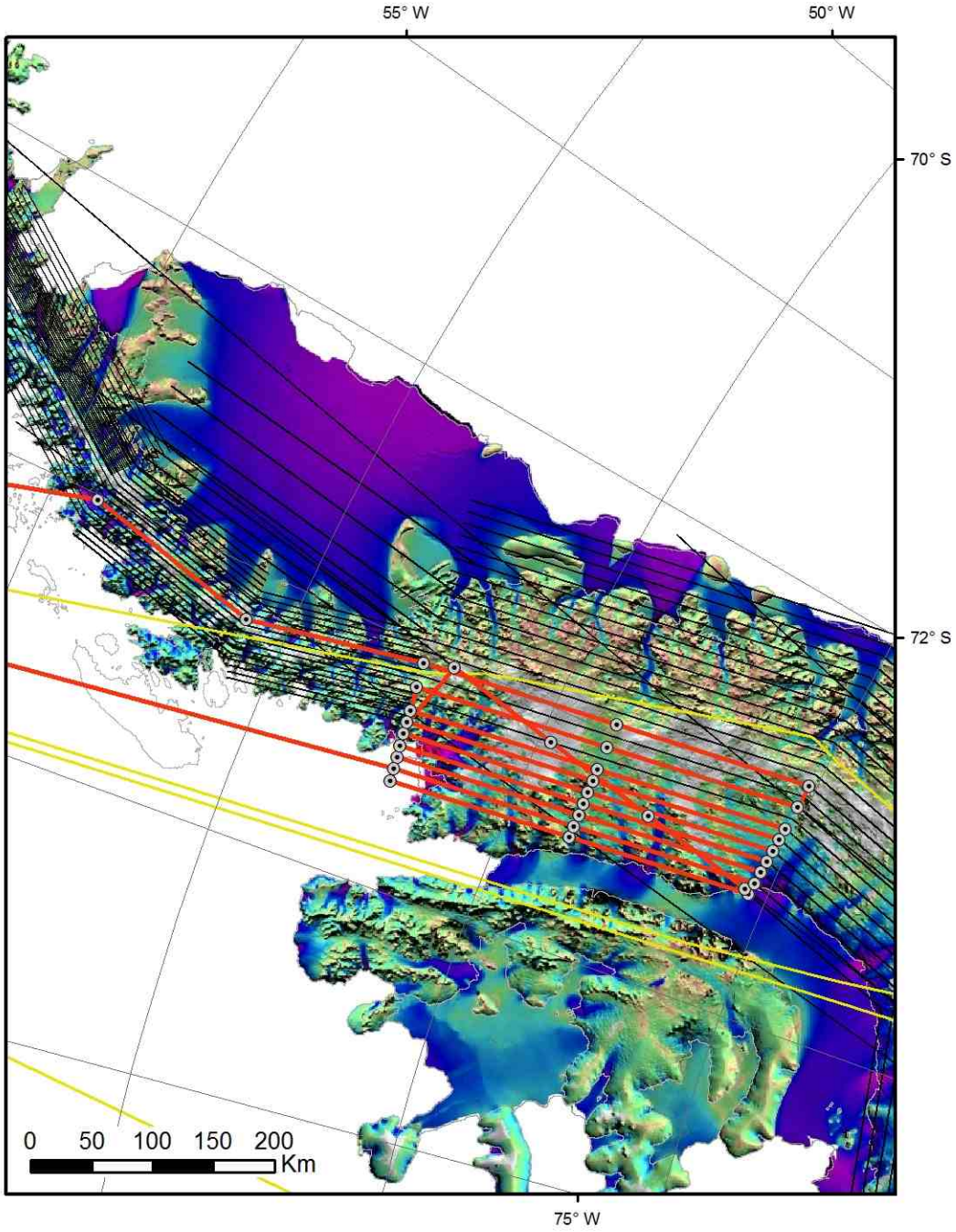


Peninsula: Priority 1
Flight: Larsen Base

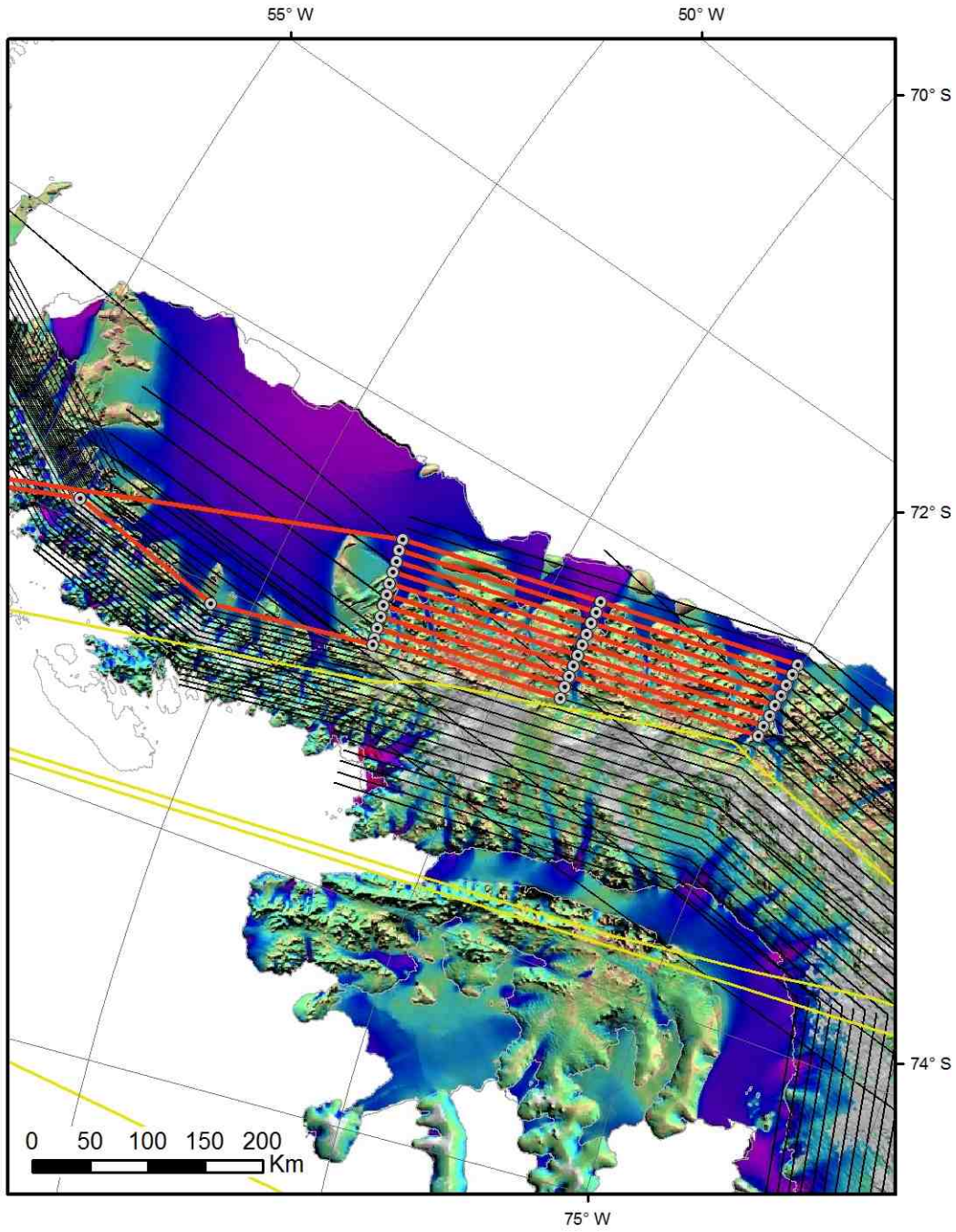
5km line spacing
Repeat of Icesat-1 track: 0263
Also overflight of several ~2km wide sections of Icesat tracks as part of grid.



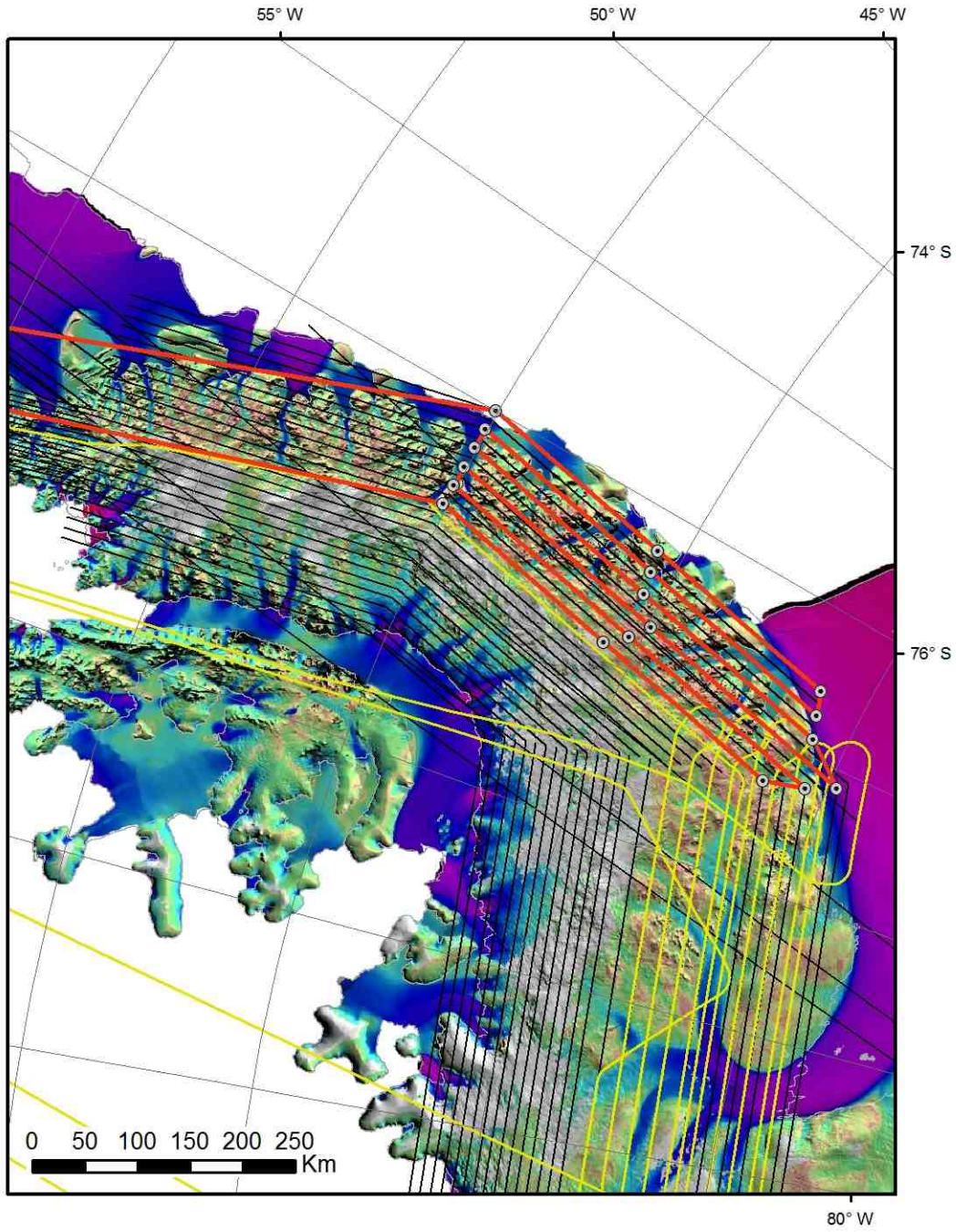
Dyer: Priority 4
Flight: W Dyer ***Within P4 Area: High***
10km line spacing at coast, 20km inland
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Shown including transit over Peninsula (little impact on flight time).



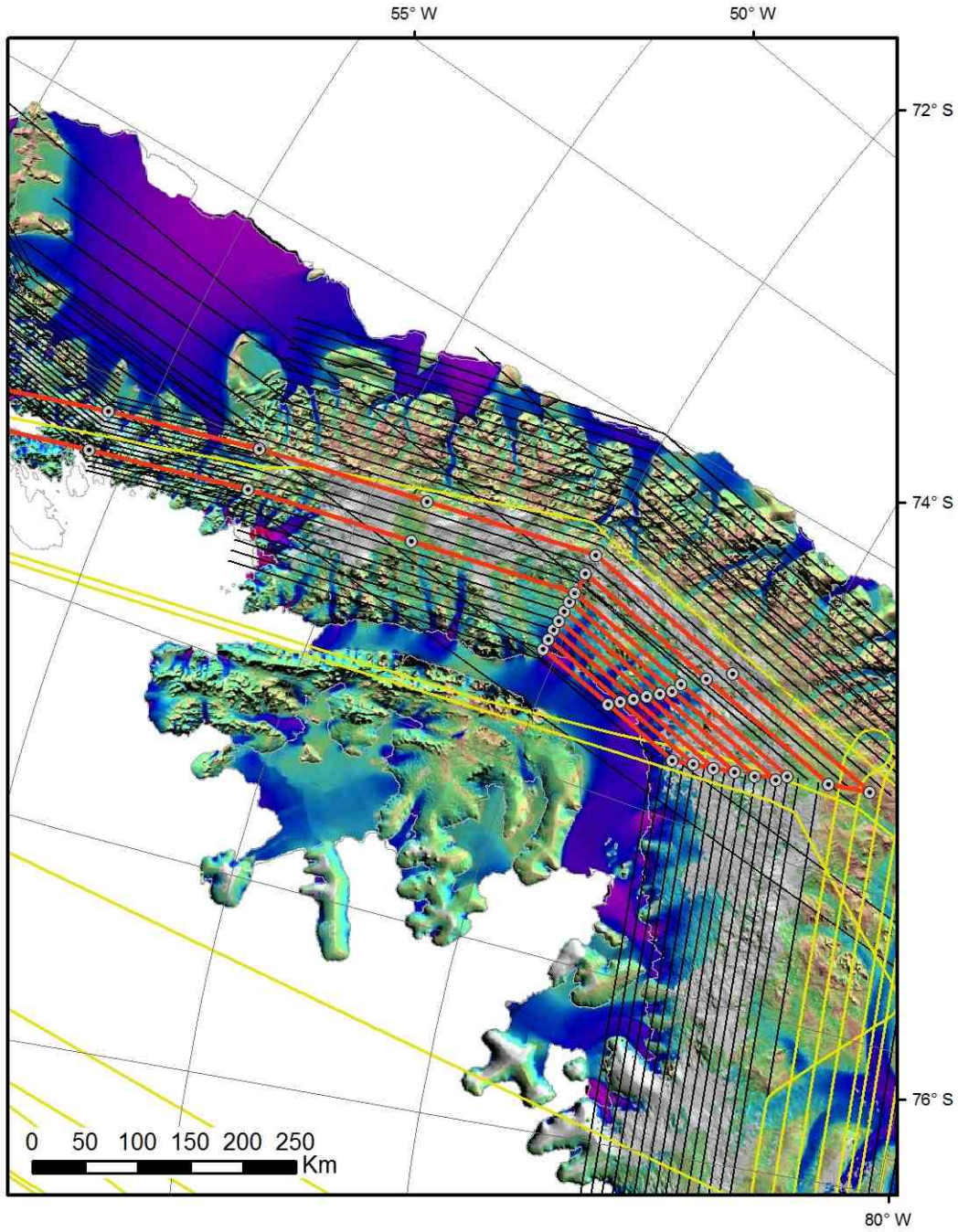
Dyer: Priority 4
Flight: E Dyer ***Within P4 Area: Lower****
10km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Shown including transit over Peninsula (little impact on flight time).
**** A successful DC8 flight in the area would mean we move this flight more inland.***



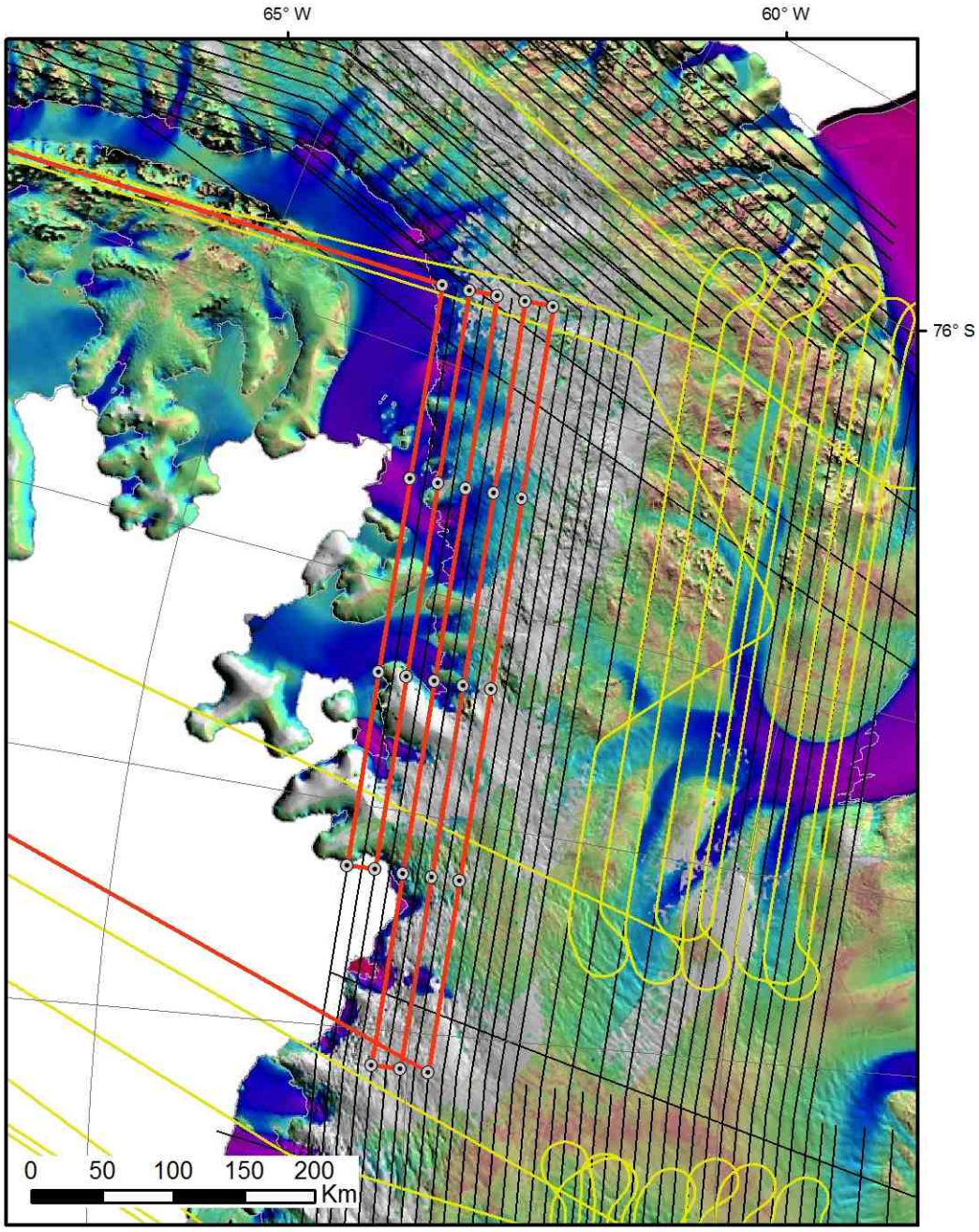
Palmer: Priority 5
Flight: E Palmer ***Within P5 Area: Lower***
20km line spacing
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



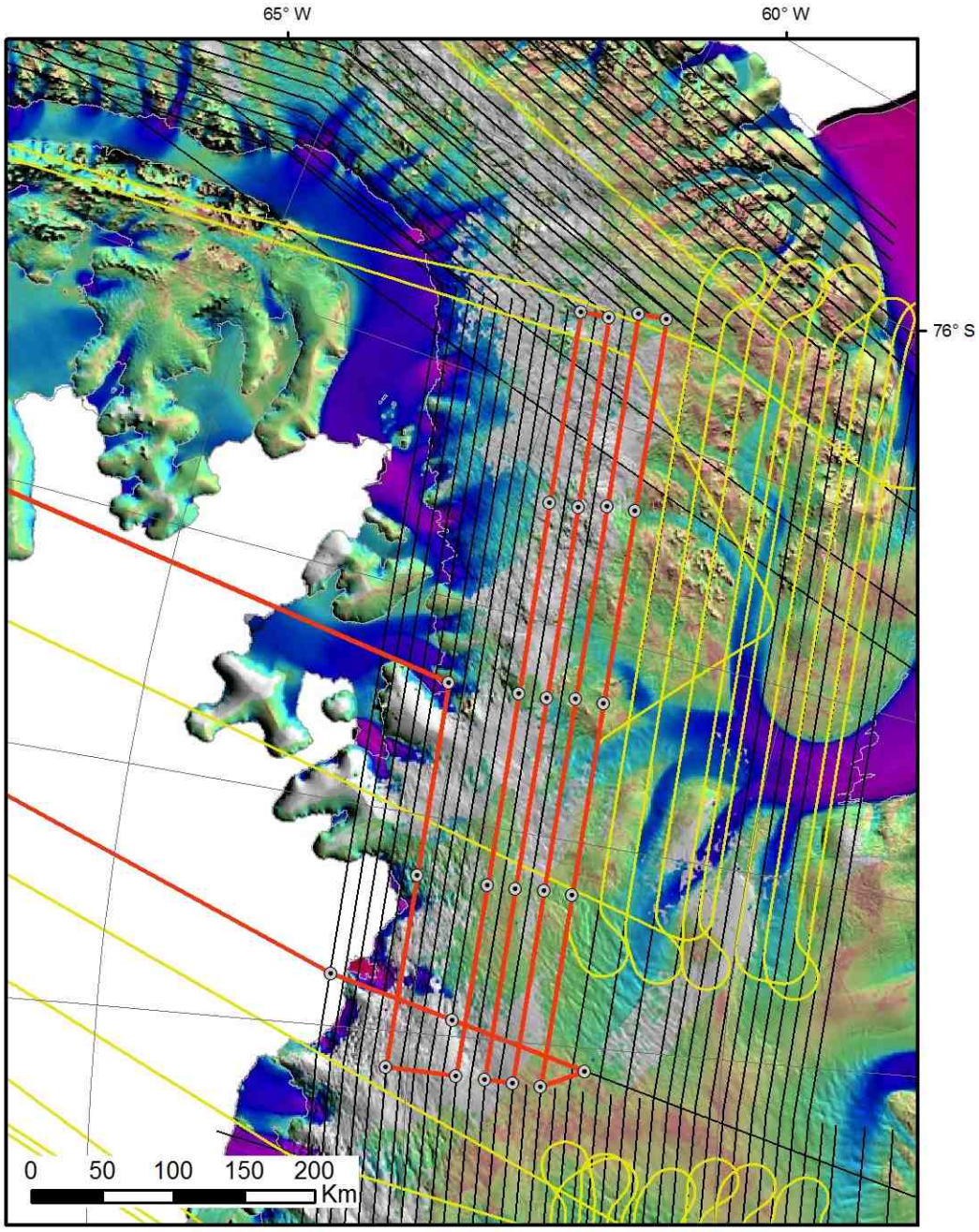
Palmer: Priority 5
Flight: W Palmer ***Within P5 Area: High***
10km line spacing, 20km spacing inland
Repeat of Icesat-1 track: none
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



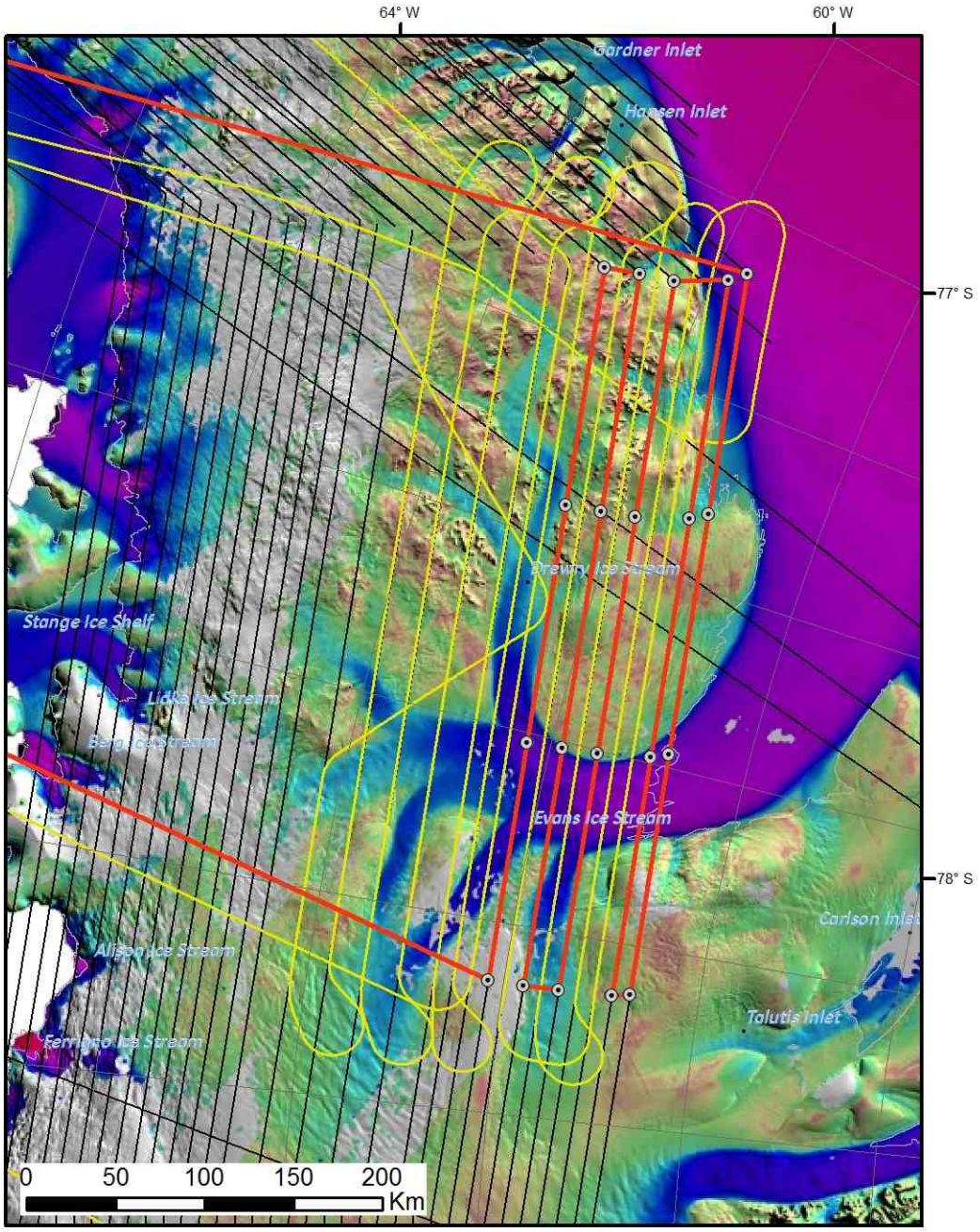
Ellsworth: Priority 3
Flight: N Ellsworth ***Within P3 Area: High***
20km line spacing
Repeat of Icesat-1 track: still to be selected at lower end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



Ellsworth: Priority 3
Flight: S Ellsworth ***Within P3 Area: Medium***
20km line spacing
Repeat of Icesat-1 track: 1320
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

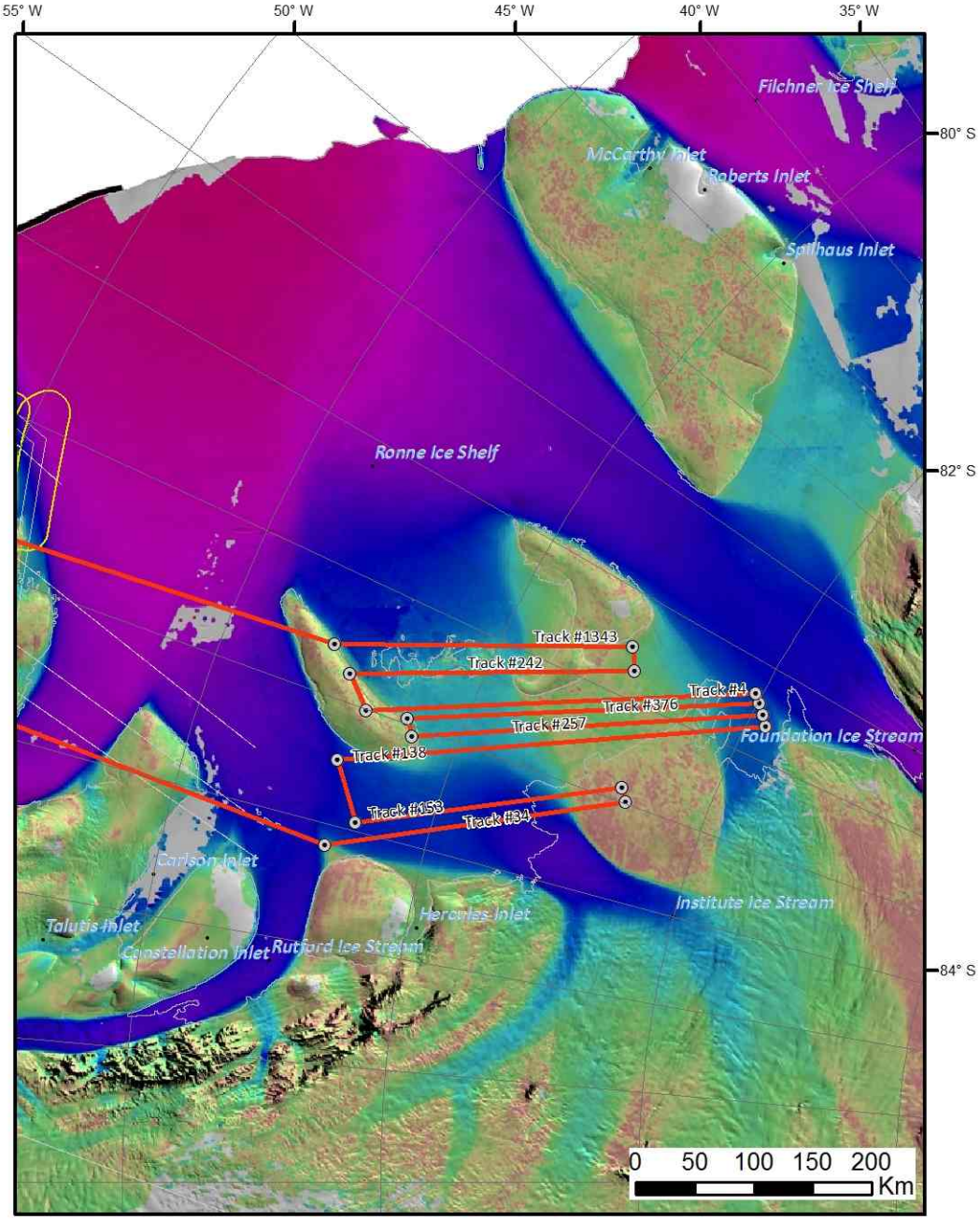


Evans: Priority 3
Flight: Evans Fill ***Within P3 Area: Lowest***
20km line spacing. With 2011 data, completes establishment of 10km grid in the region
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

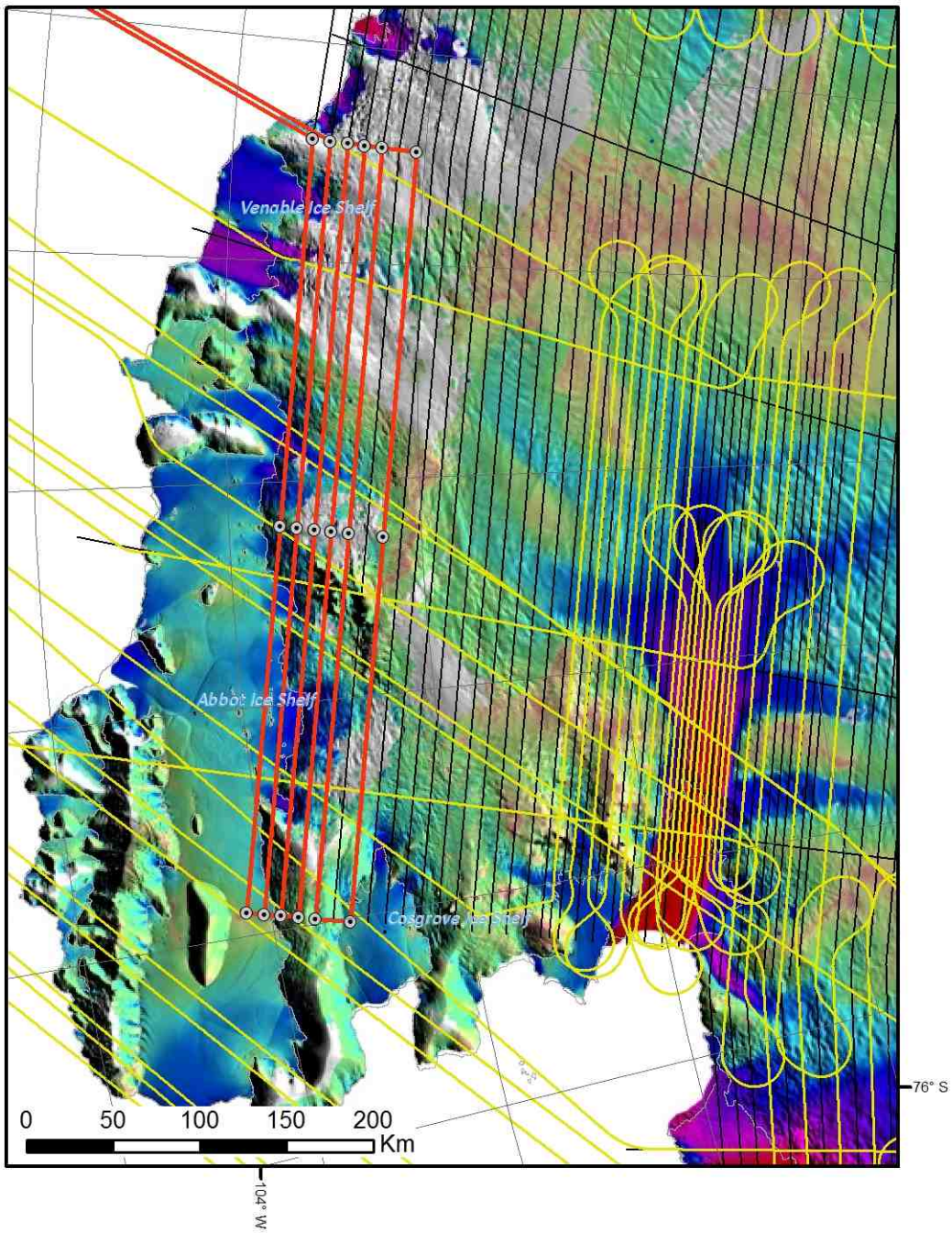


Institute-Ice Plain: Priority 2 ***High***

Repeat of Icesat-1 tracks: 0034, 0153, 0138, 0257, 0376, 0004, 0242, 1343
6/17/12: Flight shifted to downstream of Institute where grounded ice could start floating in the future. Enhances DC8 2011-2012 tracks in region.
Fly bottom to top (ie rhs of last 2 lines can be shortened more if needed for time)

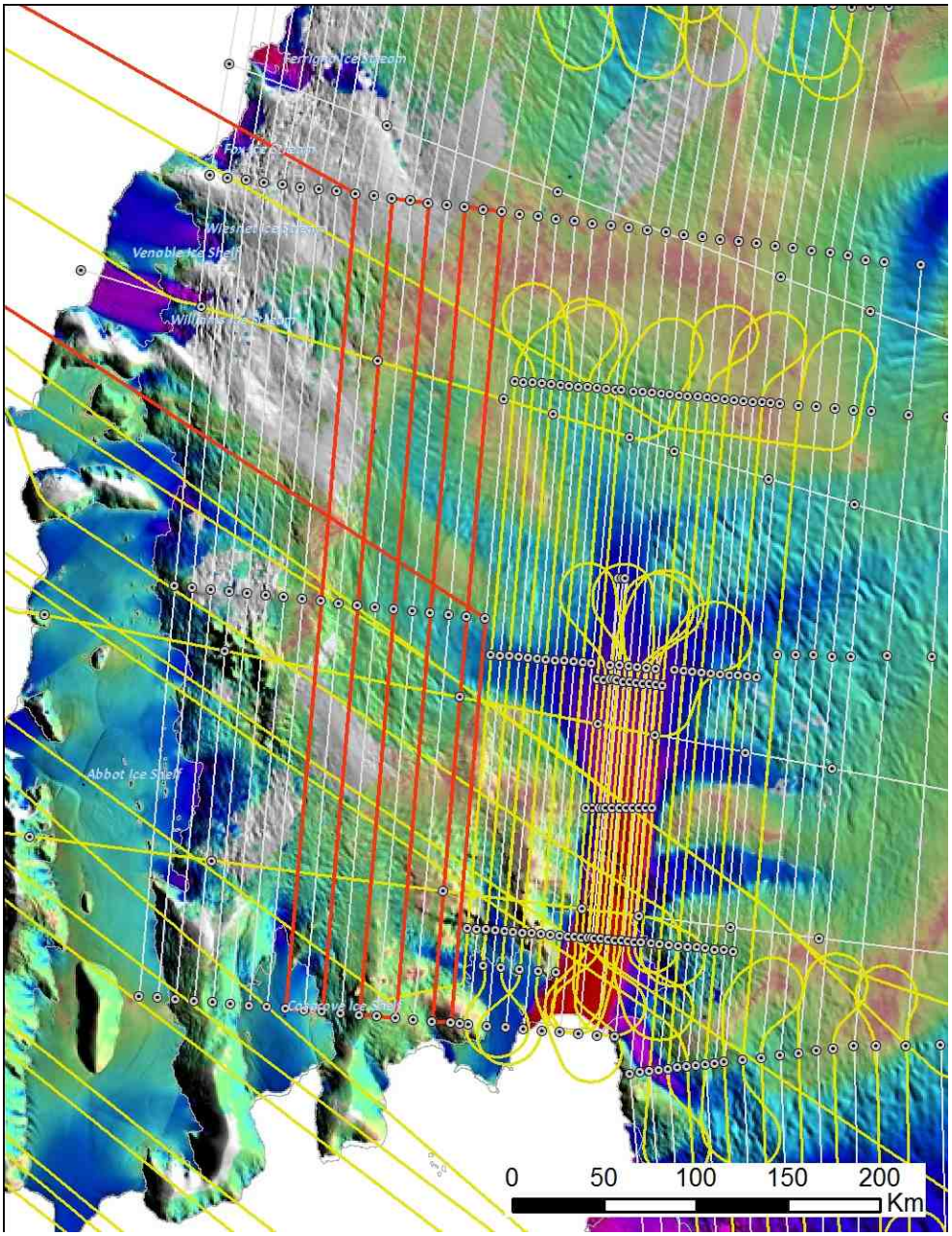


PIG Area: Priority 2
Flight: Abbot Coast ***Within P2 Area: Medium***
10km line spacing at coast, 20km inland
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



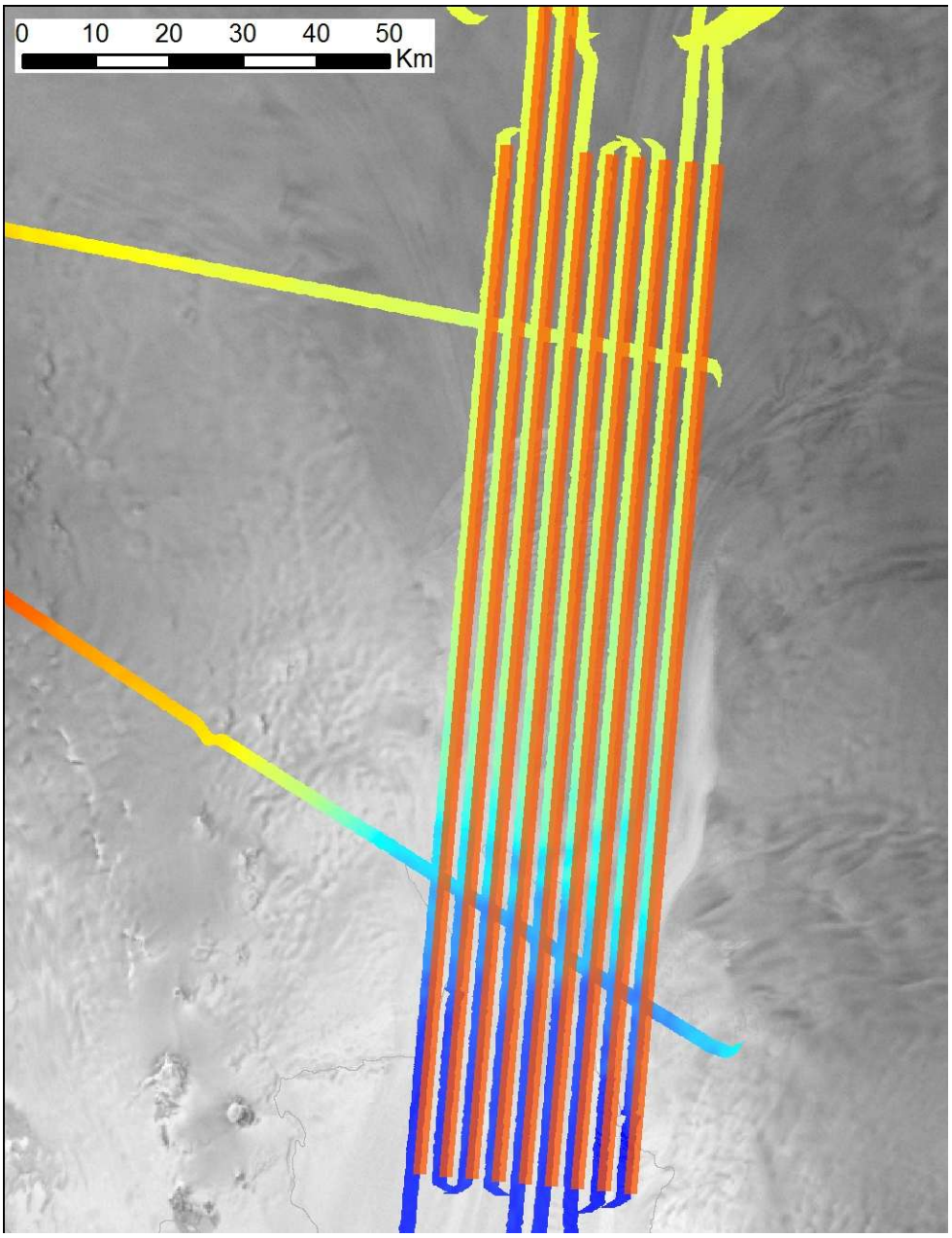
PIG Area: Priority 2
Flight: PIG A ***Within P2 Area: Low***

Part of PIG area strategy: 20km grid with lines closer to PIG higher than those further away.
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



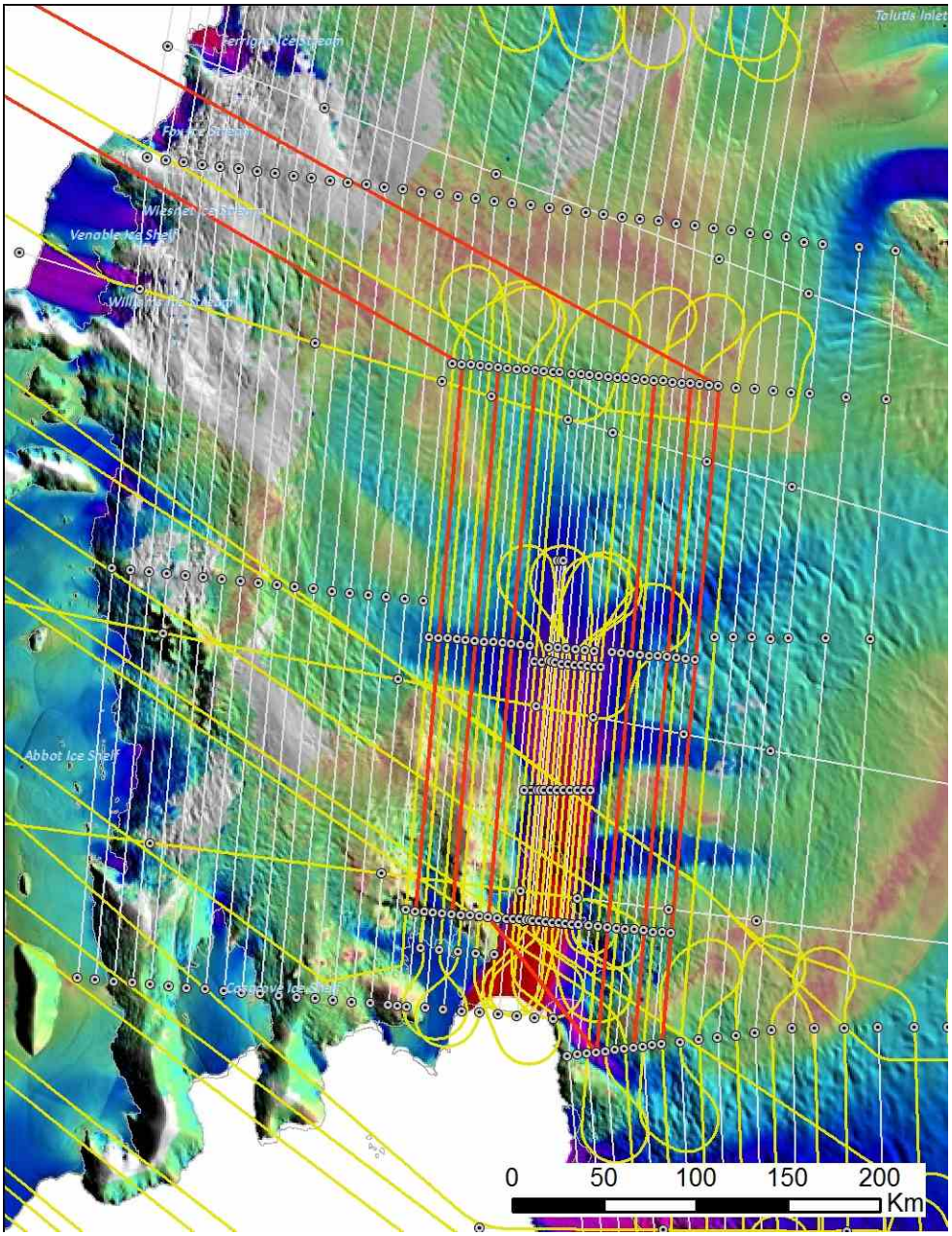
PIG Area: Priority 2
Flight: PIG Offset Repeat ***Within P2 Area: High***

Repeats 2009, 2011 flights but has each pass offset by 900m to the (image) right (tracks still spaced by 1.8km track). Expected location of 2012 data swaths shown in orange, 2011 elevation data shown colored.
Flight can repeat 900m of 9 out of total 11 of the 2011, 2009 data swaths.
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



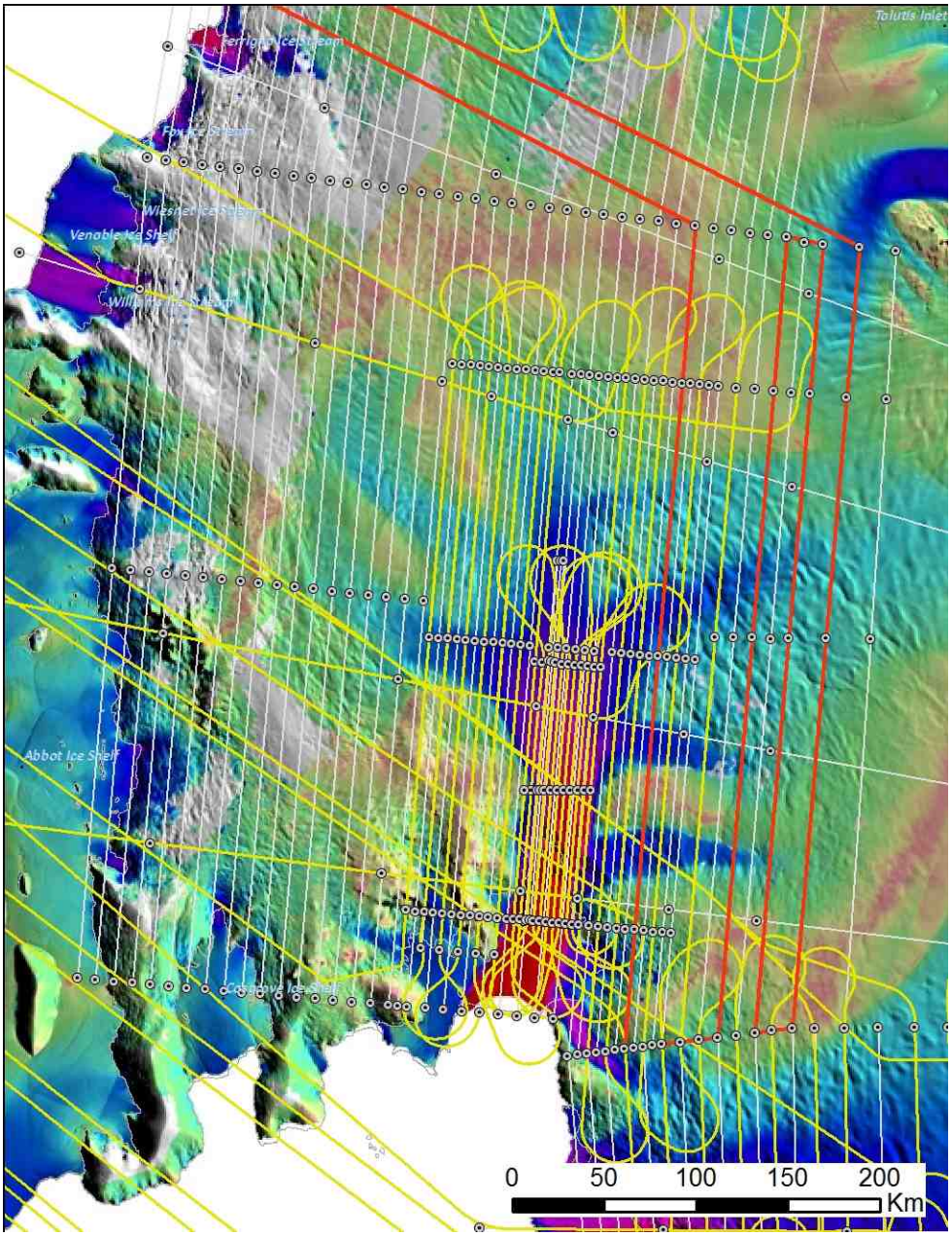
PIG Area: Priority 2
Flight: PIG C ***Within P2 Area: Medium***

Part of PIG area strategy: 20km grid with lines closer to PIG higher than those further away.
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

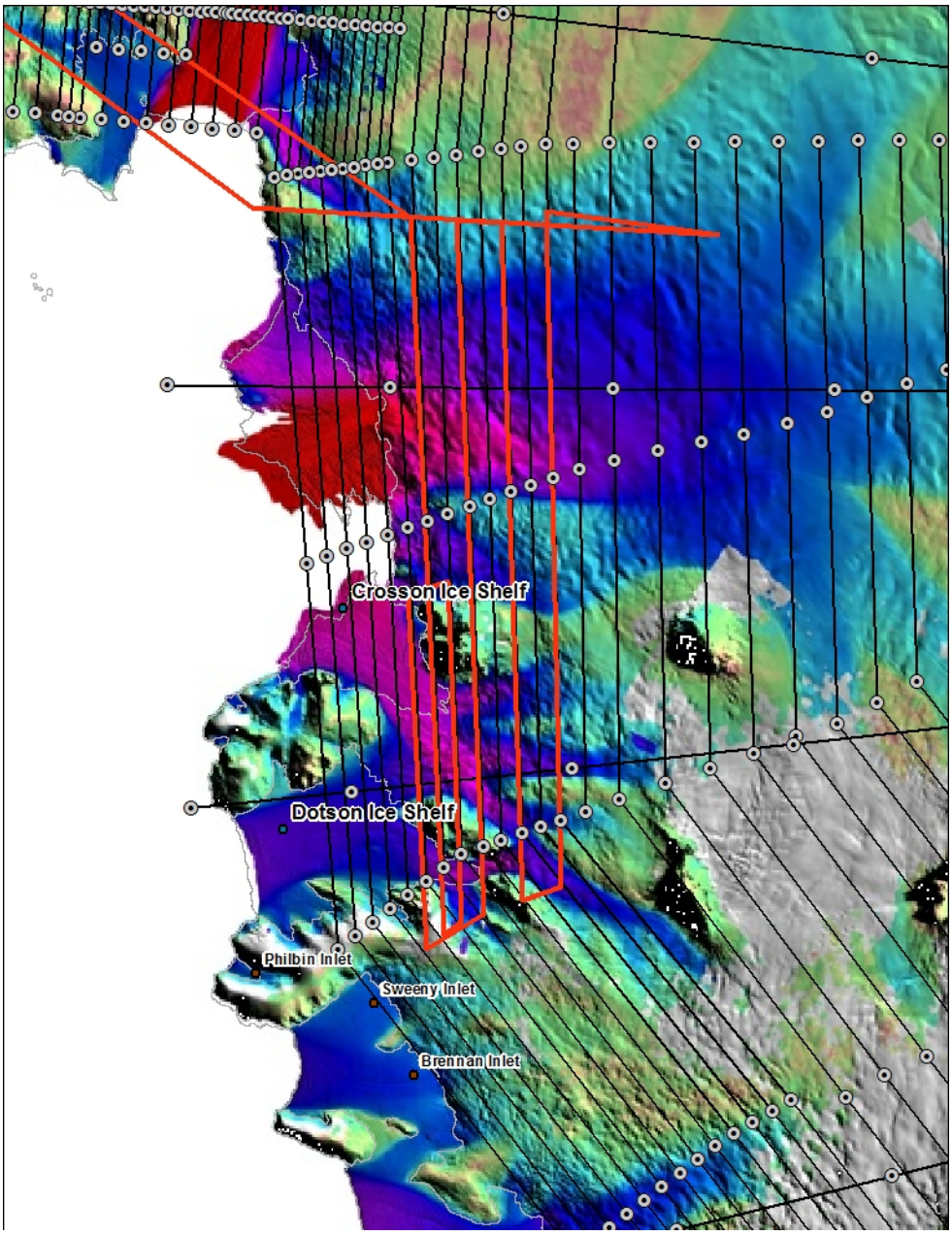


PIG Area: Priority 2
Flight: PIG Fill ***Within P2 Area: Low***

Part of PIG area strategy: 20km grid with lines closer to PIG higher than those further away.
Repeat of Icesat-1 track: still to be selected at upper end (on transit in)
Also overflight of several ~2km wide sections of Icesat tracks as part of grid

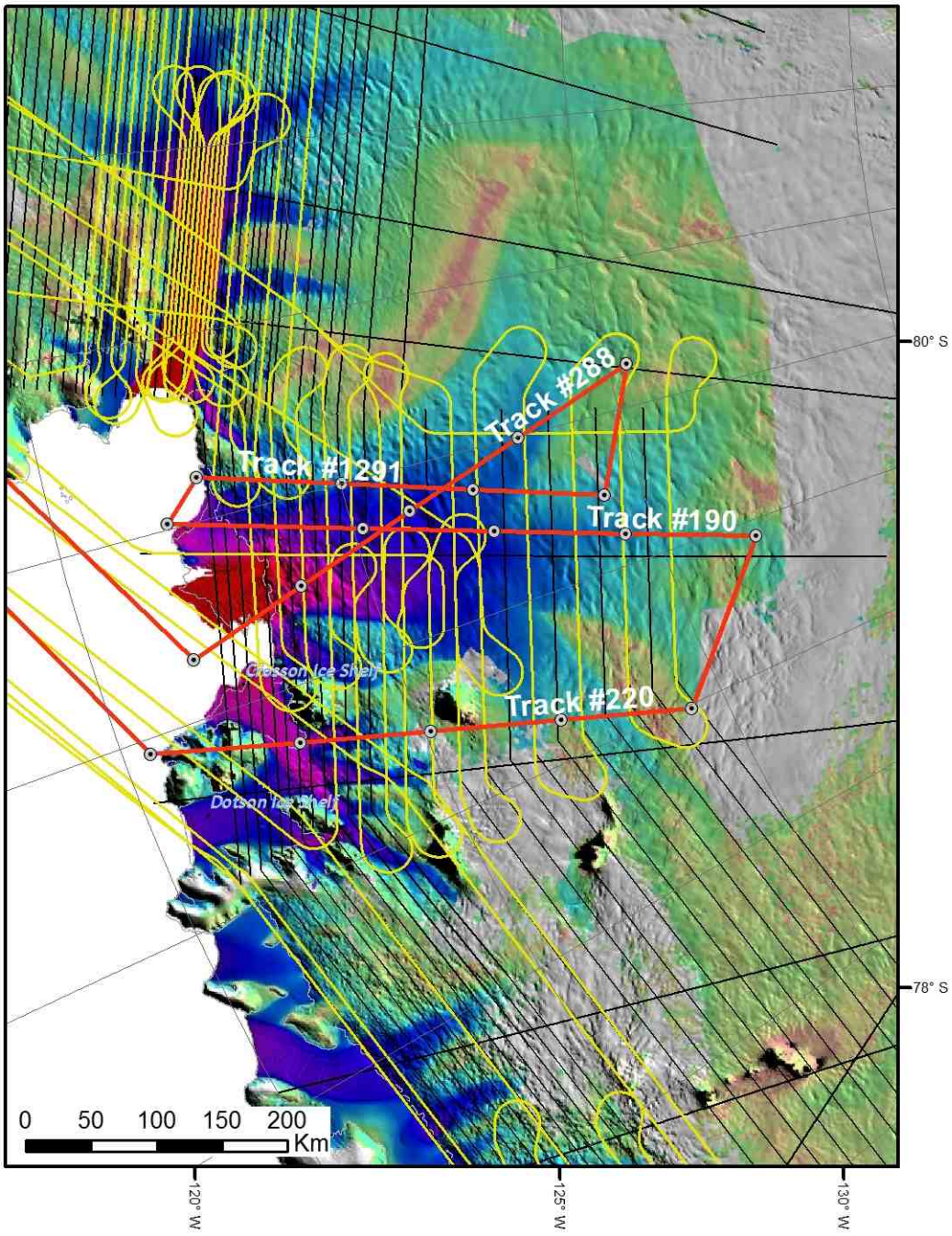


Thwaites-Pope Area: Priority 2
Flight: Pope Coast ***Within P2 Area: High***
Completes coastal grid started in 2011.
Repeats line on Crosson Ice Shelf and Smith Glacier
Repeat of Icesat-1 track: 0056
Also overflight of several ~2km wide sections of Icesat tracks as part of grid
Any time issues: Shorten slightly bottom end of lines or top of the 2 shorter lines.

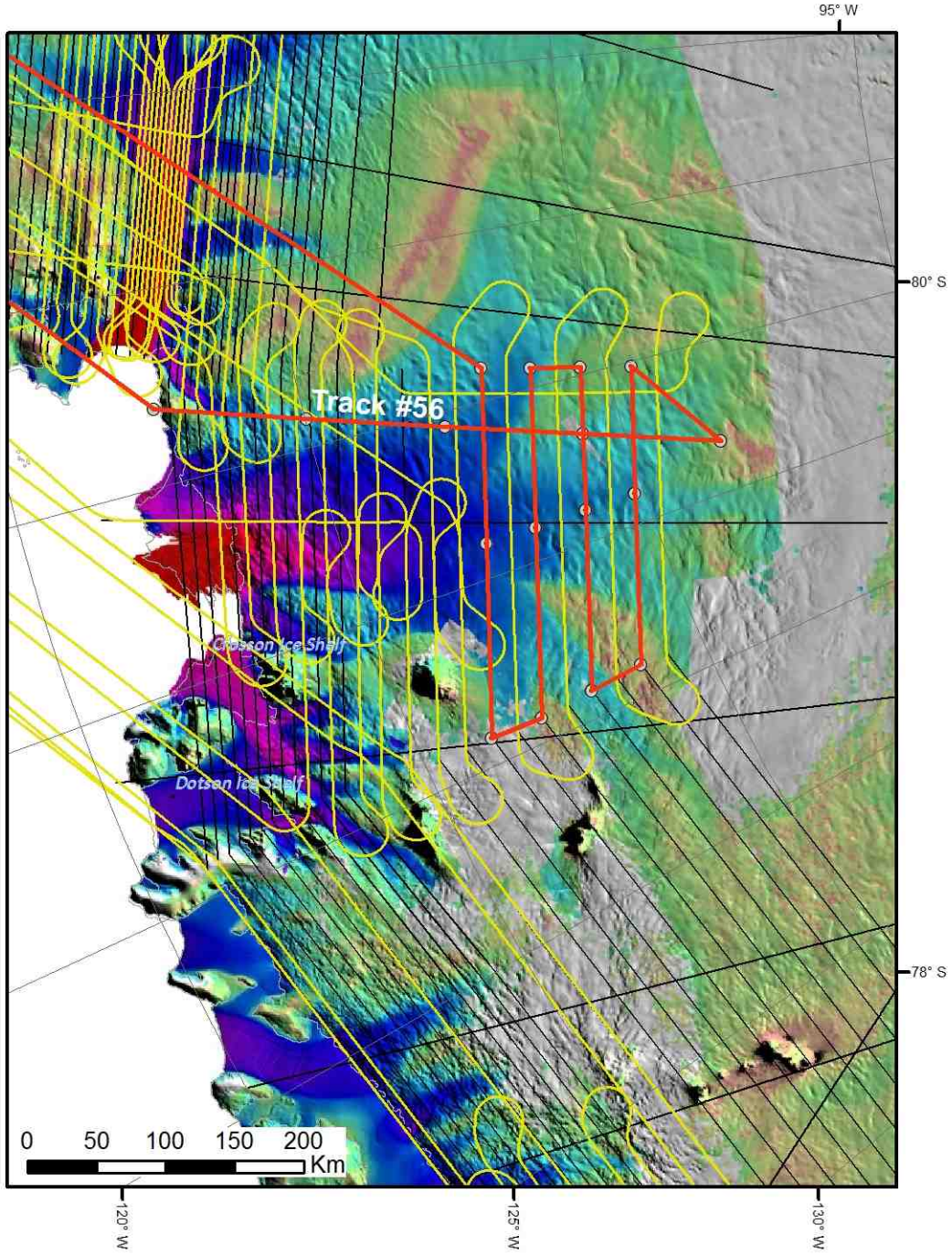


Thwaites-Pope Area: Priority 2
Flight: Pope Icesat ***Within P2 Area: Medium***

Repeat of Icesat-1 track: 0288, 0220, 0190, 1291
In order: 228 and 190: cross Thwaites trunk in interesting drawdown area; 220 : directly down partially-floating Pope Gl area with high melt rate; 56: crosses possible active lake; 354: crosses Smith near present grounding line; 1291: crosses possible active lake

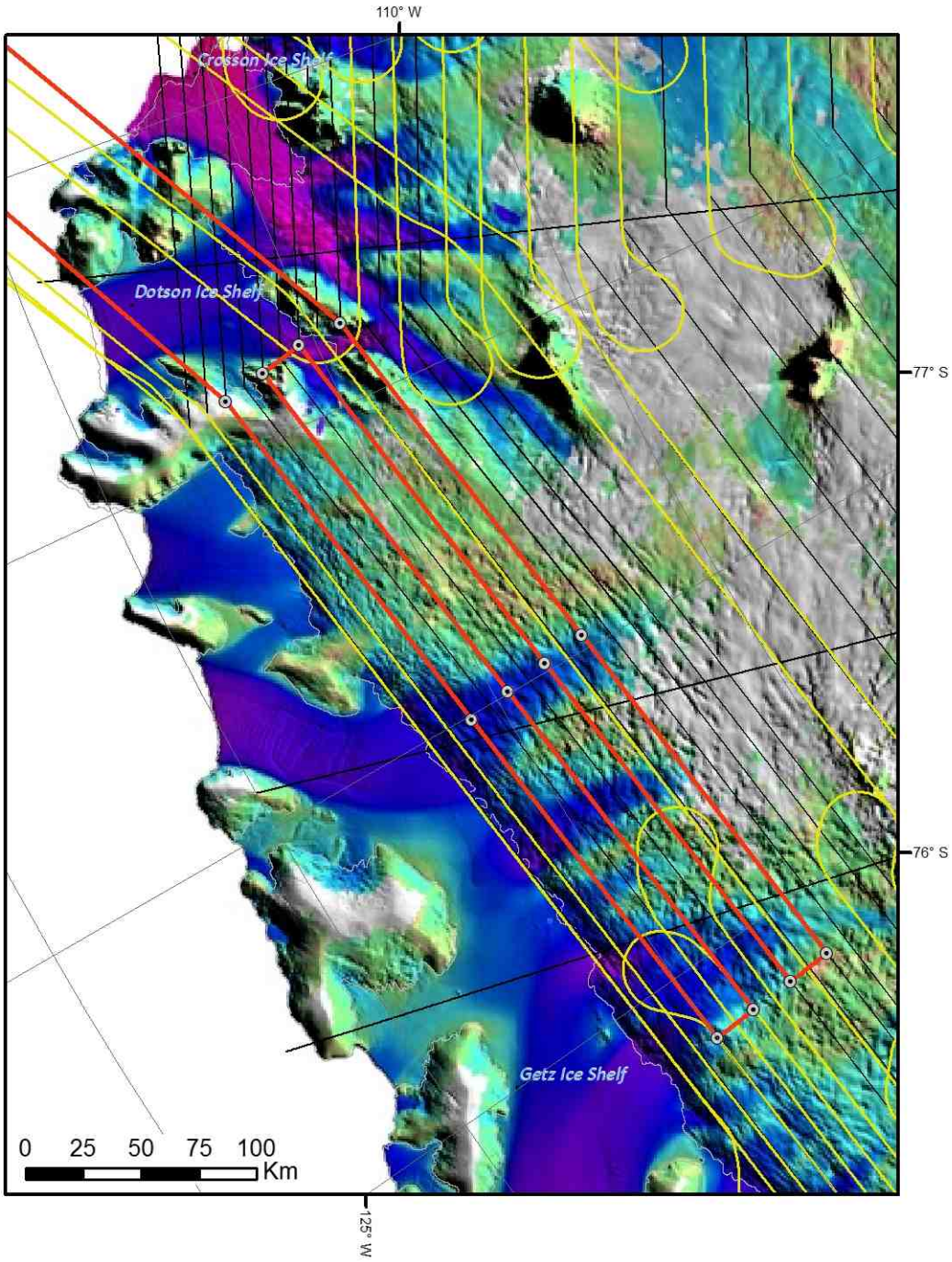


Thwaites-Pope Area: Priority 2
Flight: Inland Thwaites ***Within P2 Area: Low***
Completes 20km grid started in 2011
Repeat of Icesat-1 track: 0056
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



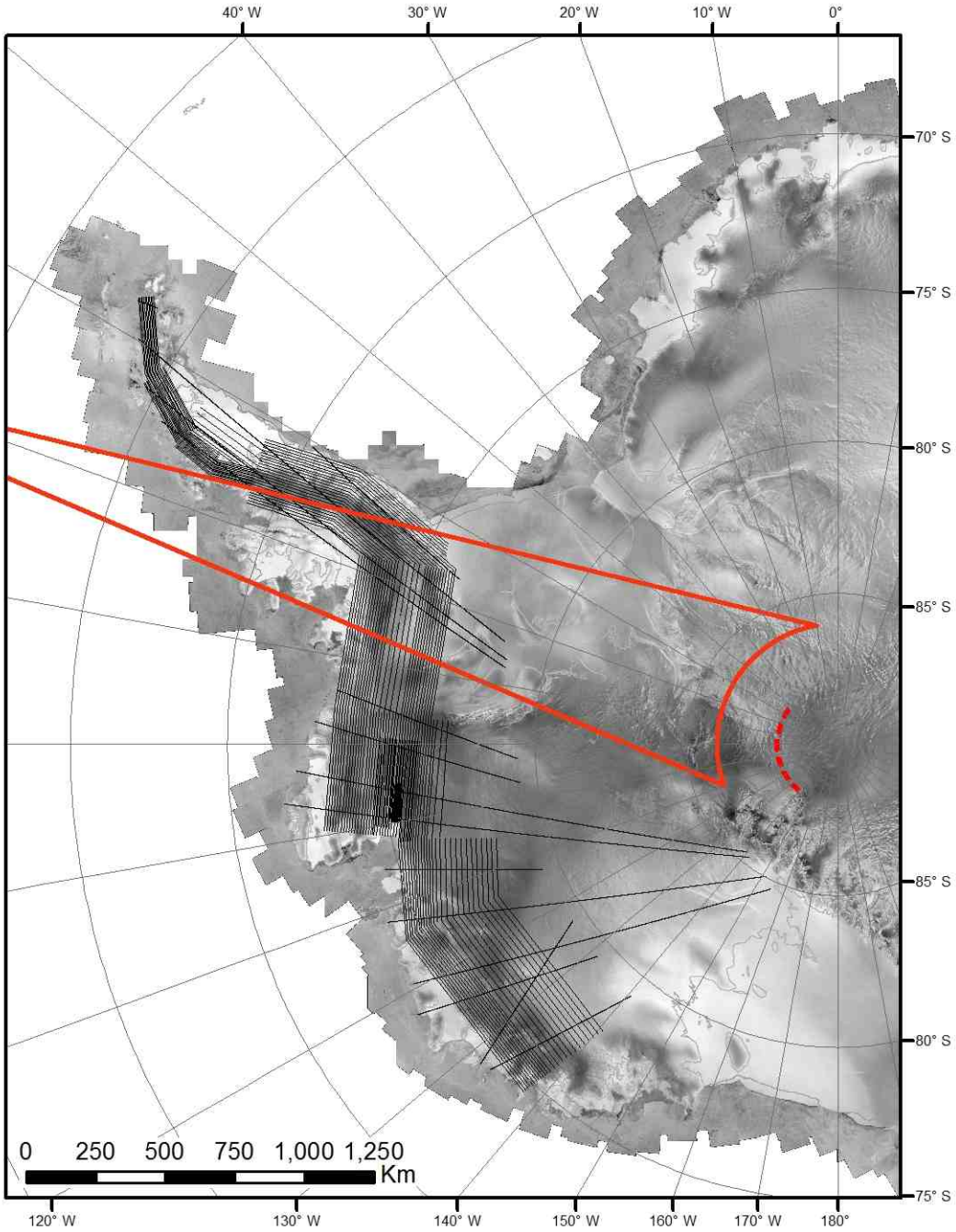
Getz Area: Priority 6 **UPDATE after DC8 deployment**
Flight: Upper Getz
Enhances 10km coastal grid over Marie Byrd land begun in 2011

Repeat of Icesat-1 track: TBD
Also overflight of several ~2km wide sections of Icesat tracks as part of grid



PoleHole: Priority 2 Low

~90deg arcs around 86S or 88S. TBD.



Sea Ice: LVIS Endurance Medium

This mission repeats a portion of the Endurance mission flown earlier in the 2012 Antarctic IceBridge campaign by the DC8, specifically the leg running closest to and roughly parallel along the peninsula (i.e. 301a to 302, per the coordinates used in the summary of the DC8 recommended flight lines). The primary aim of the mission is to explore the application of the G-V instrument suite to estimate sea ice thickness, building on the more advanced understanding of interpreting data from the DC8 instrument suite. Since the G-V mission will be flown after the DC8 mission, it also provides the opportunity to observe the physics associated with the melt season and the impact of the melt on the data quality. It is important that the LVIS data are accompanied by orthorectified digital imagery to support the IceBridge mission goal of providing high quality sea ice thickness observations in regions of significant interest. The determination of sea ice thickness relies heavily on the use of the othorectified digital imagery to evaluate the elevation data and to establish the degree of certainty in the thickness estimate.
Both legs important but shorter leg is less critical All parts of longer line are equally important.. Important to repeat track flown by DC8 (i.e., no offset).